Corduroy Creek Bridge
U.S. Highway 60, milepost 328.3
Show Low vicinity
Navajo County
Arizona

HAER No. AZ-27

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Western Region
Department of Interior
San Francisco, California 94102

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Historic American Engineering Record

HAER No. AZ-27

Corduroy Creek Bridge

Location:	Spanning Corduroy Creek on U.S. Highway 60, milepost 328.3; 12.2 miles southwest of Show Low; unplatted Township 8 North, Range 21 East; Navajo County, Arizona. UTM: 12.578135.3774110
USGS Quadrangle:	Long Tom Canyon, Arizona (7½ Minute Series, 1976)
Date of Construction:	1936-37
Designer:	Arizona Highway Department
Builder:	Pleasant-Hasler Contracting Company, Phoenix AZ
Fabricator:	Bethlehem Steel Company, Bethlehem PA
Present Owner:	Arizona Department of Transportation
Present Use:	Highway bridge (scheduled for dismantling and moving)
Significance:	The Corduroy Creek Bridge and Cedar Canyon Bridge - two almost identical, steel girder-ribbed arches - were the last links completed on U.S. Highway 60 between Globe and Springerville in 1937, and among the last links in the national highway. The two structures are thus historically noteworthy as original components of a regionally important northeast Arizona route. They are technologically significant for their representation of steel arch design by the state highway department. Visually striking as it spans a picturesque mountain canyon, the Corduroy Creek Bridge is an important, well-preserved example of an uncommon structural type.
Report Assembled by:	Clayton B. Fraser Fraserdesign Loveland Colorado

April 1992

The Historic American Engineering Record [HAER] documentation for the Corduroy Creek Bridge was conducted by Fraserdesign of Loveland, Colorado, under contract with the Arizona Department of Transportation. The Department has proposed dismantling the bridge's superstructure and moving it to function as a parallel span to a similar steel arch over nearby Cedar Creek. This recordation is intended to mitigate in part the impact on the bridge by this action. Field recording of both the Corduroy Creek Bridge and the Cedar Canyon Bridge [HAER No. AZ-26] was undertaken in July 1990. The research for this project has involved two primary archival sources: the Arizona Department of Transportation and the Arizona State Library, both located in Phoenix.

Stretching between Springerville and Ehrenberg, U.S. Highway 60 has historically formed an important east-west route across central Arizona. The highway functioned as a heavily trafficked ancillary route for U.S. 66 across the northern part of the state, and it provided a vital link between the cities in the Salt River Valley - Phoenix, Tempe, Mesa - with the rest of the state. During the 1920s the Arizona Highway Department improved almost all of the route through the state to current highway standards. All, that is, except the stretch between Globe, in the Pinal Mountains, eastward to Springerville, near the state's eastern border. This rugged and remote section represented the last segment of the transcontinental route to be built. "Practically the entire route of Highway 60, with the exception of that part from Globe to Springerville, or about 130 miles, is completed and in good shape," wrote W.A. Sullivan, an officer of the U.S. Highway 60 Association, in 1933. "It is therefore necessary, in order to make U.S. Highway 60 a travelled tourist highway and of use to the country at large, the road from Globe to Springerville by the way of Show Low must have early completion."[1]

In the late 1920s, the Arizona Highway Department [AHD] began planning for construction of this segment. Intended to complete the last leg of the transcontinental route, the road would link Springerville, Show Low and other towns on the Mogollin Rim with the town of Globe - and, by extension, with Phoenix. Department engineers initially considered upgrading the existing regional route, a road built in part by soldiers from Fort Apache.[2] But the Rice-McNary Road, as this territorial route was called, was still little more than a wagon trail, despite construction over the previous four years to improve it. "Except for [a] section twenty miles north of White River, the work of building [the Rice-McNary Road] up to the standard highway of today would be the same as constructing a new road," wrote Percy Jones, AHD Chief Locating Engineer, "and the topography of the country traversed is not as well adapted to our present standards of alignment and grades."[3]

Rather than upgrade the existing road further, the highway department instead surveyed an all-new route in 1930-31. As explained by Jones in February 1931: "The route as it is being planned is the most direct obtainable from the towns of central Arizona, through Globe to the grazing and timber country north of the Rim. That count[r]y supports a considerable population in numerous settlements of which Show Low is a centrally located one. At the town of Springerville, it will connect with U.S. Route 70, making a route much shorter than the existing ones for travelers entering the state from the middle west on their way to central and southern Arizona to southern California."[4] Ironically, part of the route followed another territorial wagon road, the Globe-McMillan route, abandoned some forty years earlier.

The proposed highway would branch from the existing road just east of Globe and would extend northwestward past the Apache Mountains to the Salt River. The crossing of the Salt, some 43 miles northwest of Globe, formed a pivotal point in the highway's route. Here, AHD engineers chose a "nearly perfect" bridge site in a constricted canyon.[5] Beyond the Salt River, the route climbed a steep, three-mile incline from the Salt River Canyon to the Flying V Canyon, and from there it continued a long, gradual climb to the Mogollin Rim. The route passed through a natural gap in the rim near Show Low and then veered eastward and eventually southward to Springerville. The Salt River crossing would require the largest bridge along the proposed route, but other major spans would be required to cross Seven Mile Wash, Carrizo Creek, Cedar Canyon and Corduroy Creek.

With the route design completed early in 1931, the highway department divided the 130-mile road into a series of shorter sections and began letting contracts for its construction under the umbrella of Federal Aid Project 99. Section A, the first one undertaken, included some of the route's most rugged terrain. Work on it began in mid-June of that year. Using everything from mule teams to trucks, tractors and power shovels, the contractors proceeded through summer rainstorms and sub-zero temperatures in the winter, blasting, filling and grading the road through mountainous terrain on the San Carlos Indian Reservation. Unlike all subsequent sections, this part of the construction was completely isolated and could only be reached by an old 18-mile-long mine road from the town of Hilltop. A.F. Rath, AHD resident engineer in charge of the project, complained:

> **Great difficulty was experienced getting in and out during the winter and spring months. Snowdrifts, mud disgustingly deep under a light blanket of snow, and high centers, made travel impossible at times. Tractors broke trail and brought in supplies when the snow was too deep for trucks to get through and in the spring it was necessary to keep a light tractor on the road constantly in order to pull trucks and cars out of the bogs.[6]**

The first three miles of this section had to be abandoned because of the mud, but they were eventually picked up in 1932. Finally, after eighteen months of brutal construction, Section A was completed near the end of the year. Comprising the southernmost 10.8 miles of the route, Section B began just outside of Globe and extended through the Crook National Forest to Apache Peak. This part of the highway also ran through rugged terrain but was far more accessible than Section A. Construction on it advanced more rapidly through completion in July 1932. Sections C and D, built in 1932-33, passed through rolling woodlands before making the steep descent into the Salt River Canyon.

As construction progressed on the highway, the Depression deepened across the country; soon a premium was placed on employment for the local work force. Labor-intense hand work was used extensively in lieu of mechanized construction, and the work schedule was changed from the standard eight-hour, five-day shift to two five-hour, six-day shifts with extended furloughs to employ more workers and push construction. "Except for a few, all skilled and unskilled employees were Gila county men," reported Rath. "Labor reports compiled from records show that for a period of 50 weeks the two jobs [Sections C and D] averaged 180 men per day... The benefits derived from roadwork spread over a large area, if one should care to follow it through from start to finish."[7] Using these methods, some 42 miles of highway had been graded between Globe and the Salt River Canyon by October 1933.

The steep rock walls and constricted contour of the Salt River Canyon called for a single-span bridge to carry the roadway high above the river. For this natural crossing, the AHD bridge department engineered a single-span steel arch that flexed against the canyon walls on concrete pedestals. The Salt River Canyon Bridge was an innovative structure - only the third steel arch built for Arizona's highway system. The first had been the three-hinged through arch erected over the Colorado River near Topock, funded by a tripartite agreement between the U.S. Bureau of Indian Affairs and the states of Arizona and California. Designed in 1914 by San Bernadino [California] County Engineer S.A. Sourwine, the 592-foot arch was apparently patterned after the Bellows Falls Arch Bridge [1905] in New Hampshire. A breathtakingly bold structure, the Topock Bridge was the lightest and longest three-hinged arch in America at the time of its completion in 1915.[8] Two years later, the state highway department attempted its own long-span steel arch for a crossing of the Gila River in Greenlee County. State Engineer Thomas Paddock in 1917 delineated a 312-foot deck arch to carry the Clifton-Solomonville Road high above the river. Steel shortages caused by World War I drove the price of the arch well beyond the budget, however, and the design was scrapped in favor of a two-span concrete arch.[9] It was several years before the highway department actually built its first steel arch: the 616-foot-span Navajo Bridge over the Colorado River. Completed in 1929, the Navajo Bridge was another extraordinary structure - as dramatic as it was graceful - that carried the roadway high above the Grand Canyon.[10]

With a span length of 162 feet, the Salt River Canyon Bridge was modestly scaled compared with the three other arches. It differed from its predecessors in a more important aspect, however. The other arches all employed three-hinged configurations, with spandrel-braced webs. The Salt River Canyon Bridge, on the other hand, used riveted steel plates in lieu of the complicated trussing of the spandrel braced arches, and it eliminated the mid-span hinge. The girder-ribbed arch design weighed more than its spandrel-braced counterpart, but it simplified fabrication and erection considerably, saving both time and money. In locations that did not require extensive cantilevering, the girder-ribbed arch proved more economical to build. Its adoption by AHD represented an evolutionary step in bridge engineering.

The highway department designated the bridge's construction Section E and in September 1933 contracted with the Lee Moor Construction Company of El Paso, Texas, for its fabrication and erection. The contractor began immediately on the concrete arch pedestals. The Salt River Canyon Bridge and its approaches presented multiple curvature problems - "more, in fact, than any bridge so far constructed in the state," according to Rath." As a result, its construction went slowly. In January 1934 work on the first pylon began. Each 18-ton arch girder was erected in five sections that spring, and in June the immense structure was completed. "From a distance and with its aluminum paint shining in the sunlight, the structure looks more like a delicate piece of filigree than a well designed and constructed highway bridge," rhapsodized Rath.

Completion of the Salt River Canyon Bridge marked the symbolic halfway point on the Globe-Springerville Highway. Although almost 90 miles remained between the bridge and Springerville, once out of the Salt River Canyon most of the path ahead was relatively mild compared to the rugged construction in Sections A through D. Rath wrote in July 1934:

> **From this point ahead, the construction is all for the future and there is a slight possibility that another Section A may turn up; but I doubt that very much. The next few miles will be heavy construction, as expected. The work will then become easier and less complicated, although heavy work is bound to be found in spots. Whatever its nature may be, it will take two or maybe three hundred men constantly at work daily to finish the next twenty miles within the next year, with the odds in favor of a greater count than that.**[12]

The highway department dubbed the three-mile climb up the other side of the canyon Section F and subsequent segments Sections G through J, as construction progressed steadily northward between 1934 and 1936. Meanwhile, work had begun on the highway from the Springerville side under Federal Aid Project 105. Again, AHD divided the construction into smaller segments, the first of which extended from the outskirts of Springerville. One of the last segments designated - F.A.P. 105-E - involved the erection of the two bridges over Cedar Canyon and Corduroy Creek southwest of Show Low.

AHD's bridge department designed these structures along similar lines as the Salt River Canyon Bridge, with the main spans comprised of two-hinged, girder-ribbed arches.[13] (*See Appendix for original construction drawings of the two bridges by the Arizona Highway Department.*) The arch spans of the Corduroy Creek and Cedar Canyon bridges are identical. The two structures differ only slightly in their abutments, piers and approach spans, reflective of the slightly different topography. Each bridge spans 180 feet from pin to pin of the end hinges. Like the Salt River Canyon Bridge, the arches of the Corduroy Creek and Cedar Canyon structures are comprised of two girder ribs, spaced 21 feet apart to support a 24-foot-wide roadway. The arches are curved along a 144'4" constant radius on their centerlines, with a 31'6" rise from bearing pin to crown centerline.[14]

Each arch rib bears into a massive concrete pedestal by means of a cast-steel bearing shoe and a 7-inch-diameter pin. The ribs are comprised of a half-inch-thick, 60-inch-deep steel plate, reinforced on top and bottom by built-up flanges that consist of two 7"x4"x11/16" angles and a 15"x11/16" flange plate. The web plates are further reinforced by web stiffeners, each made up of two 6"x4"x3/8" angles and two 4"x11/16" plates. With such a deep profile, the arch ribs possess a high moment of inertia along their axes. But their relatively narrow flanges leave them vulnerable to lateral loading, necessitating extensive lateral bracing. A system of built-up struts and diagonal braces joins the two arch ribs rigidly, forming what functions essentially as an arched box beam. Riveted to the upper flanges of the ribs at 17'3" intervals are *12 WF 40* columns that support the roadway. A *24 WF 94* floor beam is riveted to the top of each column. The floor beams carry four lines of *18 WF 47* stringers, which in turn carry the concrete deck.

As on most highway bridges of the time, the configuration and details of the Corduroy Creek and Cedar Canyon bridges have been simplified to the extent possible, with decorative treatment limited to the ancillary components. The guardrails are made up of square welded steel tubes, supported by low, curved-top concrete posts. Concrete bulkheads at the bridges' corners are stepped and flared slightly outward. Mounted on top of each arch pedestal is a decorative vertical pylon comprised of steel channels spaced apart by steel plates. Each pylon extends above, and is integrated with, the guardrail; the channel tops are stepped downward from the center to the edges. The streamlined profile of the arch ribs, combined with the stepped bulkheads and pylons, give the bridge a distinctive Art Moderne character, typical of the AHD detailing for the period.

As an alternative to the steel arches, the Bureau of Public Roads San Francisco office delineated reinforced concrete arches for both crossings in June 1936. Like AHD's design, the Bureau's bridges were almost identically configured, each featuring a single, two-rib, open-spandrel arch flanked by concrete girder approaches.[15] Each arch spanned 180 feet and had a 135-foot constant radius along its centerline, with a 34-foot rise from spring

line to crown. The arch ribs were doweled into concrete spread footings, and they supported tapered concrete columns, which in turn supported the roadway deck. The only appreciable difference between the two concrete bridges was in the configuration of the approach spans.

What the Bureau's concrete arches saved in superstructural steel over AHD's steel arches, they more than made up in reinforcing steel and concrete. The steel arches would require a total of 773,886 pounds of structural steel, 126,460 pounds of reinforcing steel and 768 cubic yards of concrete. The concrete arches, on the other hand, required only 1400 pounds of structural steel in the form of bronze bearing plates, but they consumed some 366,000 pounds of reinforcing steel and 1922 cubic yards of concrete. The difference in aggregate weight between the two structural types was significant. The two steel arches, with concrete footings, would weigh a total of approximately 3.9 million pounds; the concrete arches more than doubled that at 7.8 million pounds.[16]

The highway department designated the Corduroy Creek and Cedar Canyon Creek bridges Federal Aid Project 105-E: one of the last segments of highway construction from Show Low south on U.S. 60. In July 1936 the Arizona Highway Commission advertised for proposals to build the two bridges using either the steel or concrete arch designs. Bids for the steel arches were received the following month from four firms: the Pleasant-Hasler Contracting Company and the Packard Construction Company, both of Phoenix, H.H. Hagen of Globe, and the Lee Moor Contracting Company of El Paso, Texas. With none of the contractors submitting proposals for the alternate design, the concrete arches were shelved. Pleasant-Hasler's bid of $117,935.81 for the two bridges was the lowest of the four proposals; on August 8th the Highway Commission voted unanimously to approve the company's bid.[17]

Pleasant-Hasler's crew began the excavation soon thereafter, working through the remainder of summer on the bridges' substructures. As another contractor built the highway adjacent to the bridges that fall, the Pleasant-Hasler crew continued work on the concrete abutments and arch pedestals of the structures themselves. The men had the bridges about 20% complete before suspending work due to cold weather at the end of the year. They resumed construction late in March and then operated slowly throughout the following spring and summer. Using components fabricated by the Bethlehem Steel Company, the steelworkers erected the arch girder ribs in August, extending them from both ends over timber falseworks while a traveler hauled the prefabricated segments onto the bridge and held them in place for riveting. The steel erection proceeded rapidly that month. By the end of September, the project was completed, and the two bridges were opened to traffic.[18] The Corduroy Creek and Cedar Canyon Bridges have carried traffic since, with only minor, maintenance-related repairs.

Completion of the two bridges marked the last link in U.S. 60 between Globe and Springerville, and one of the last links in the national highway. The structures are thus historically noteworthy as original components of a regionally important northeast Arizona route. The Corduroy Creek and Cedar Canyon bridges are technologically significant for their representation of steel arch design by the state highway department. The Salt River Canyon Bridge marked the first time that AHD used the girder-ribbed arch, followed soon thereafter by these two bridges. Other girder-ribbed arches were later built in the state after World War II, as the highway department adopted this as its standard long-span canyon design. The 180-foot arches of the Corduroy Creek Bridge seem modest compared with the record-setting 800-foot girder arches of the Henry Hudson Bridge in New York, also built in 1936-1937.[19] But within the context of Arizona bridge building, the Corduroy Creek Bridge is significant. A much more streamlined structure than its predecessors, the Topock Bridge, the Navajo Bridge and the Salt River Canyon Bridge, it represents the prevailing trend in Arizona and the country toward simplification in the detailing of highway bridges. Visually striking as it spans a picturesque mountain canyon, the Corduroy Creek Bridge is an important, well-preserved example of an uncommon structural type.

Endnotes

[1]W.A. Sullivan, Secretary-Treasurer of the Arizona Division of the U.S. Highway 60 Association, "U.S. Highway 60," *Arizona Highways*, January 1933, page 3. In the article Sullivan briefly describes U.S. Highway 60 in Arizona and the country: "Destined to become one of the major arterial routes of Arizona when completed, United States Highway 60, running through the central part of the state, virtually bisects the state from east to west. It is one of the few roads in the nation which has been given federal designation before being finished. Its importance in the transcontinental system required recognition before it was completed. Designation has been given to the entire route, approximately four hundred and ten miles long, except a thirty-five mile link from Show Low to Springerville in North-eastern Arizona. U.S. Highway 60 starts at one ocean and ends at another. It is the only transcontinental highway passing through the central part of Arizona, starting at Norfolk, Virginia, thence through Virginia, West Virginia, Kentucky, Illinois, Missouri, Oklahoma, Texas, New Mexico, entering Arizona just east of Springerville, Show Low, Globe, Miami, Mesa, Tempe, Phoenix, Wickenburg, leaving Arizona at Ehrenberg and ending at Los Angeles, California. Highway 60 is 3,053 miles long and is 162 miles shorter than any other transcontinental highway in the United States."

[2]*Report of the State Engineer of Arizona, 1909-1914* (Phoenix: Arizona State Press, 1914), pages 33, 67, 84.

[3]Percy Jones, "Location of the New Globe-Springerville Highway Keeps Road at Lower Levels," *Arizona Highways*, February 1931, page 4. Jones listed the advantages of the all-new route over the existing one, stating:

> There are three good r[e]asons: First, elevation. This old road goes high. It is above 6,000 feet in elevation for a considerable distance on the Natanes Plateau, and while this point is not so much higher than the corresponding high spot on the new route, it is for a greater distance, and there is something in the shape of the country that makes the snow fall heavier and lie much longer. The writer was in both these places during a recent snow and the difference was quite noticeable. It goes to 6,000 again six or seven miles below the rim, as does the new route, but reaches 7,200 on the rim at McNary and from there on up to nearly 9,000 and then down to 7,000 at Springerville. In the past this road has been closed by snow for considerable periods of time. Now, due to higher standards of maintenance it is generally kept open, but at a considerable expense, and it is always liable to be closed for short periods.
>
> Second - distance. This existing route between the same principal points is 20 miles longer than the new proposed one. While it might be shortened in some places in others it would be lengthened, due to the necessity for development of distance to obtain the present standard rate of grade.
>
> Third - Cost of alignment and grade. Except for a few comparatively short sections this existing road is an old wagon road that grew upon the lines of least resistance, between watering places on the way to Ft. Apache. It has been much improved, noticeably within the last four years to one who knew it before that time. However, except for that section twenty miles north of the White River, the work of building it up to the standard highway of today would be the same as constructing a new road, and the topography of the country traversed is not as well adapted to our present standards of alignment and grades. The final cost of bringing this old road up to present highway standards would probably be equal to or greater than that of building a highway on the direct route and the result would be not as satisfactory.

[4]Ibid., page 4.

[5]A.F. Rath, "New Bridge Across Salt River and the Country Which It Will Open," *Arizona Highways*, September 1933, pages 15, 17.

[6]A.F. Rath, AHD Resident Engineer, "Highway 60 Moves Northward," *Arizona Highways*, July 1933, page 4.

[7]A.F. Rath, "Highway 60 Moves Northward," page 5.

[8]David Plowden, *Bridges: The Spans of North America* (New York: The Viking Press, 1974), page 178; "Long-Span Steel-Arch Bridge across Colorado River," *Engineering News*, 6 April 1916, pages 672-673. For information on the Bellows Falls Bridge, see "The Bellows Falls Highway Bridge," *Engineering Record*, 5 November 1904, pages 538-541, and "The Bellows Falls Arch Bridge," HAER No. NH-6.

[9]Proceedings of the Greenlee County Board of Supervisors, 4 March 1918 (Book 2, page 515), located at the Greenlee County Courthouse, Clifton, Arizona; *Third Biennial Report of the State Engineer, Arizona, 1918-1920* (Phoenix: Arizona State Press, 1918), pages 100-101; *Fourth Biennial Report of the State Engineer, Arizona* (Phoenix: Republican Print Shop, 1920), page 60.

[10]For more information on the Navajo Bridge, see Clayton B. Fraser, "The Navajo Bridge," HAER No. AZ-28.

[11]A.F. Rath, "New Bridge Across Salt River and the Country Which It Will Open," *Arizona Highways*, September 1933, page 14.

[12]A.F. Rath, "U.S. 60 Moves Northward," page 21.

[13]The Arizona Highway Department also designed a third girder-ribbed arch, along with the two bridges on U.S. 60. This third structure was to carry U.S. Highway 66 over Canyon Padre in Coconino County. The Canyon Padre Bridge, built at the same time as the Cedar and Corduroy bridges, was identical in dimensions to the other two bridges, differing only in minor details. It has since been replaced.

[14]The description of the steel arches is based upon construction drawings produced by the Arizona Highway Department in 1936, microfiche copies of which are located at the Arizona Department of Transportation, Phoenix, Arizona. These drawings are reproduced in the Appendix of this report.

[15]The description of the Bureau of Roads concrete arch designs is based upon construction drawings produced by the San Francisco office of BOR and dated June 1936. Copies of the four-sheet set for the Corduroy Creek Bridge and the six-sheet set for the Cedar Canyon Bridge are located at the Arizona Department of Transportation, Phoenix, Arizona.

[16]The weights and measurements for the two bridges are taken from materials schedules on the construction drawings.

[17]"Arizona Highway Commission Notes," *Arizona Highways*, September 1936, pages 14-16; see also, Proceedings of the Arizona State Highway Commission, 8 August 1936, located at the Arizona Department of Transportation, Phoenix, Arizona. The bids were each subdivided into 19 components, listed on the following page:

Item	Quantity	Description	Bidder			
			Hagen	Packard	Lee Moor	Pleasant-Hasler
1	14,431 cubic yards	Roadway excavation	14,431.00	16,162.72	14,431.00	16,884.27
2	7 cubic yards	Drainage excavation	14.00	7.84	14.00	8.19
3	1,443 cubic yards	Slides and overbreakage	1,082.25	1,212.12	1,082.25	1,266.23
4	959 cubic yards	Structural excavation	1,918.00	1,918.00	3,356.50	1,918.00
5	2,912 sta. yards	Station yard overhaul	145.60	116.48	203.84	87.36
6	400 cubic yards	Imported borrow	200.00	160.00	200.00	320.00
7	768 cubic yards	Class A concrete	16,896.00	25,344.00	21,504.00	18,432.00
8	126,460 pounds	Reinforcing steel	7,587.60	8,219.90	6,323.00	6,575.92
9	773,886 pounds	Structural steel	73,519.17	73,519.17	68,875.85	69,649.74
10	40 lineal feet	42" corrugated metal pipe	280.00	240.00	250.00	260.00
11	62 lineal feet	48" corrugated metal pipe	496.00	558.00	465.00	452.60
12	13 cubic yards	Cement rubble masonry	260.00	260.00	208.00	260.00
13	448 lineal feet	Road guardrail	448.00	448.00	560.00	448.00
14	17	Guide posts	34.00	51.00	42.50	34.00
15	12	Right-of-way markers	48.00	36.00	36.00	36.00
16	6,400 lineal feet	Standard wire fence	448.00	576.00	640.00	512.00
17	163 lineal feet	Crown ditches	32.60	32.60	19.56	81.50
18	290 lineal feet	Lead seal	280.00	145.00	290.00	290.00
19	120 hours	Rolling	360.00	360.00	360.00	420.00
		Total Bid	118,490.22	129,366.83	118,861.50	117,935.81

[18]"Road Projects under Construction in Arizona," *Arizona Highways*, September 1936, page 20; October 1936, page 26; November 1936, page 27; December 1936, page 31; January 1937, page 27; March 1937, page 31; April 1937, page 25; May 1937, page 26; June 1937, page 27; July 1937, page 26; August 1937, page 26; September 1937, page 24, October 1937, page 30.

[19]For more information on the design of the Henry Hudson Bridge, see D.B. Steinman and C.H. Gronquist, "Designing the Longest Fixed Steel Arch," *Engineering News-Record*, 13 August 1936, pages 232-236.

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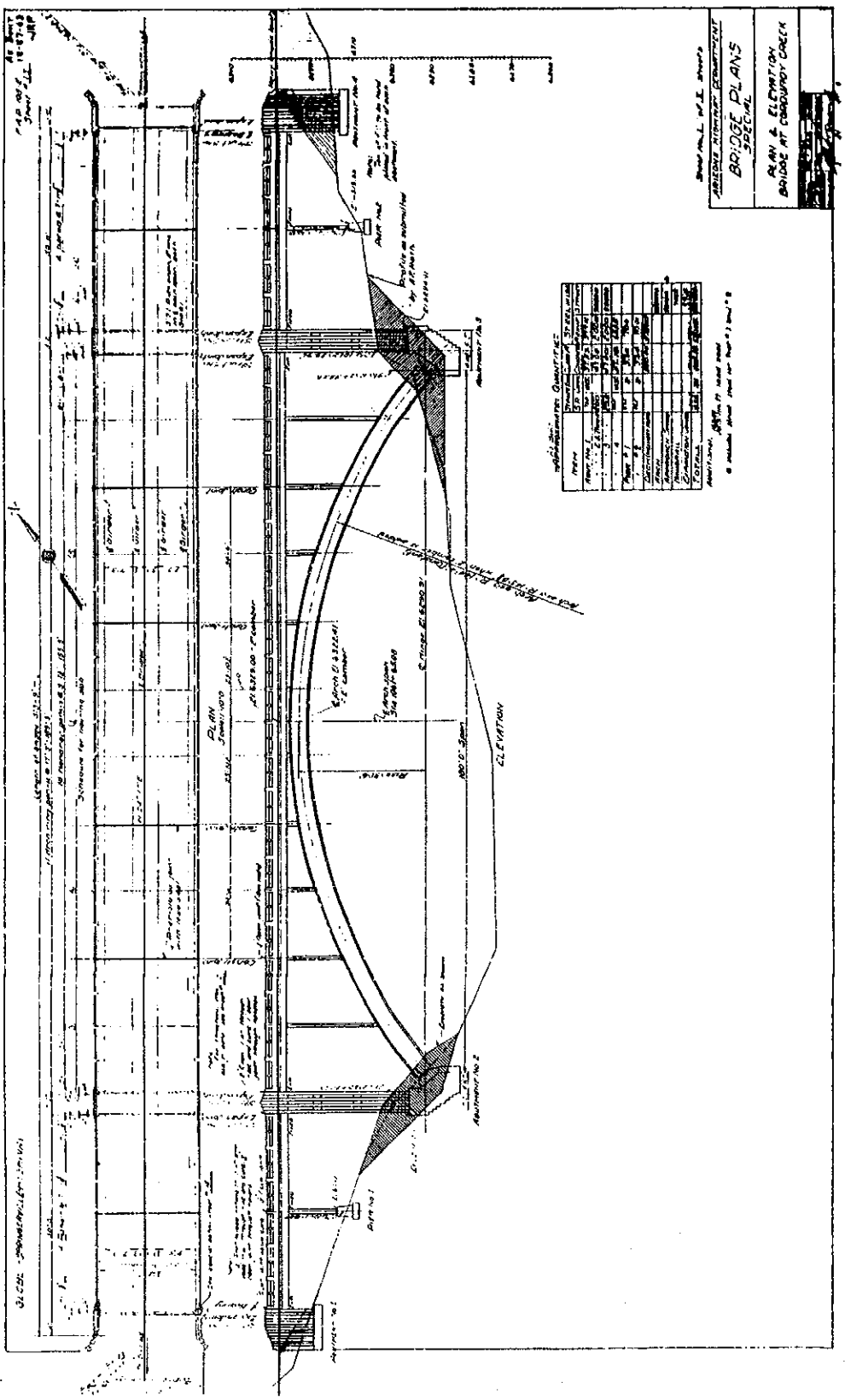
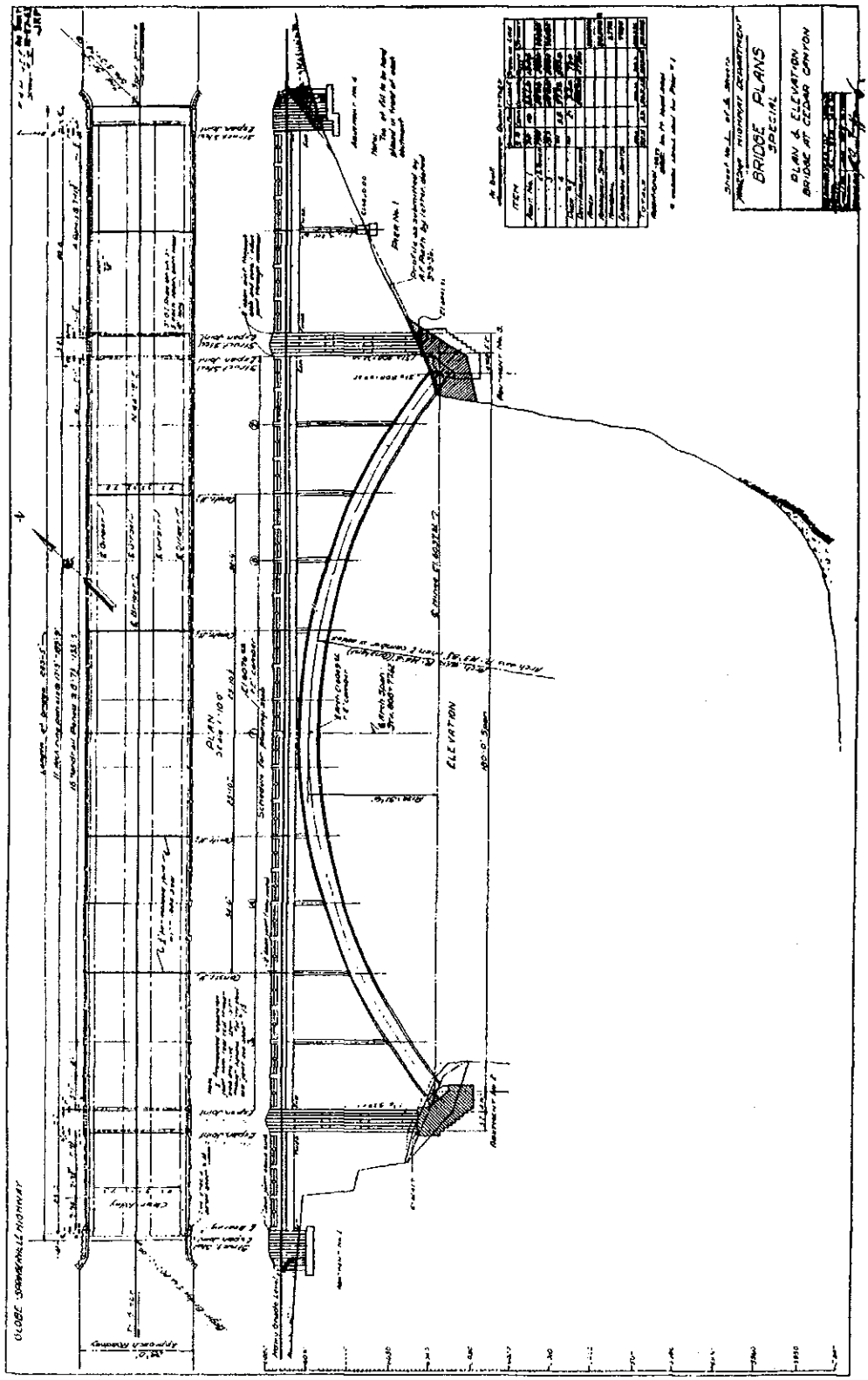
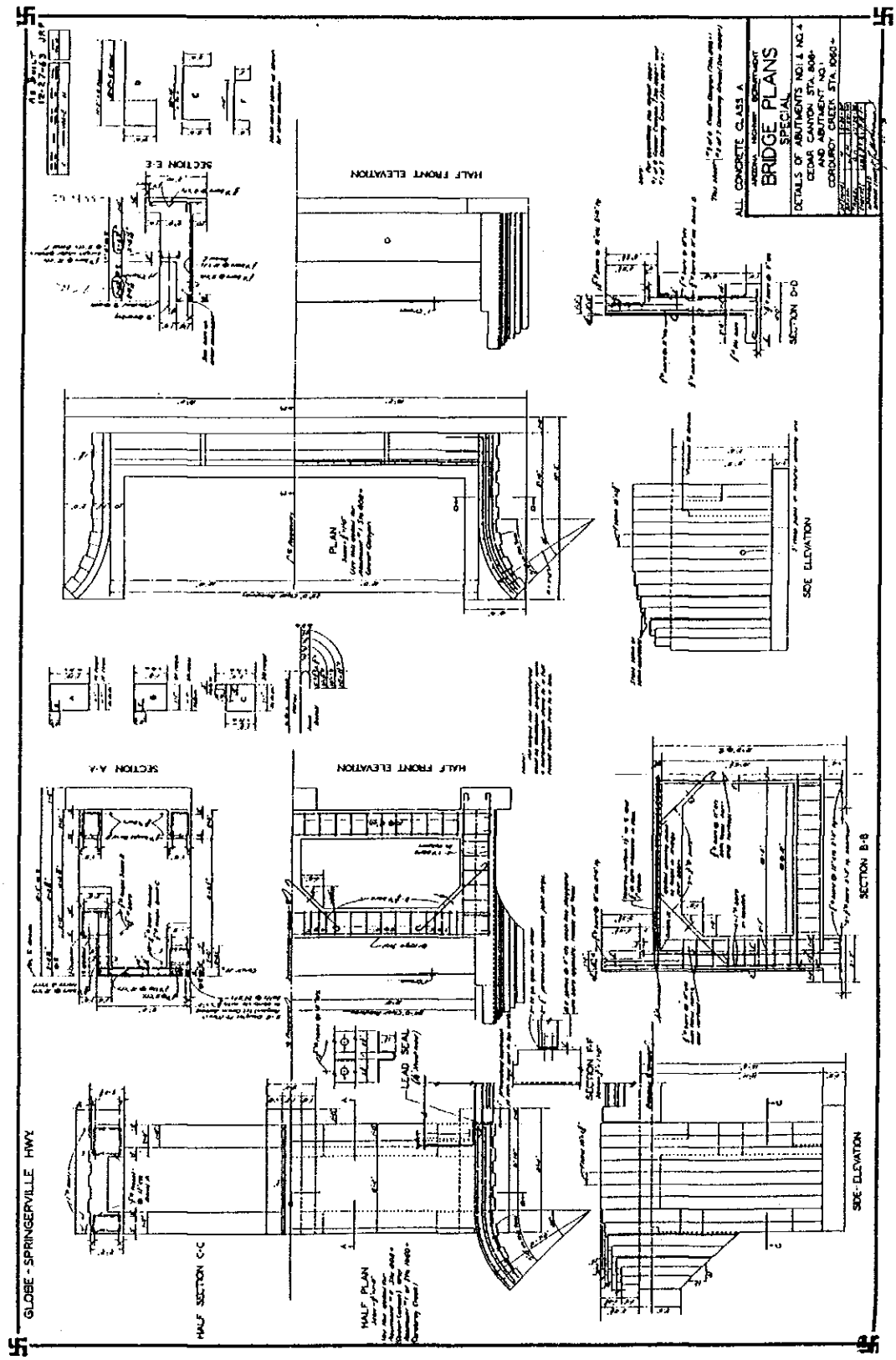
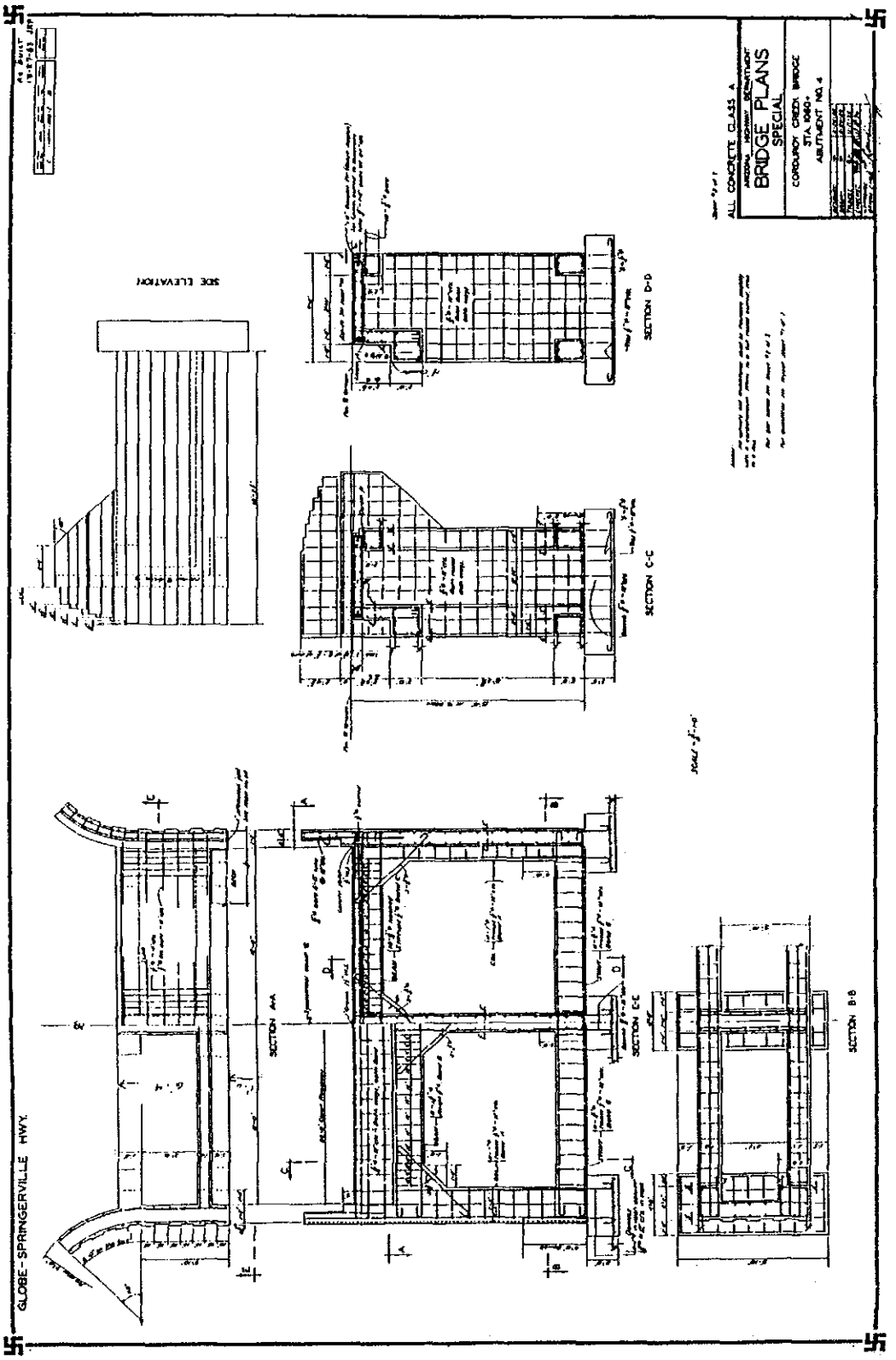
Appendix

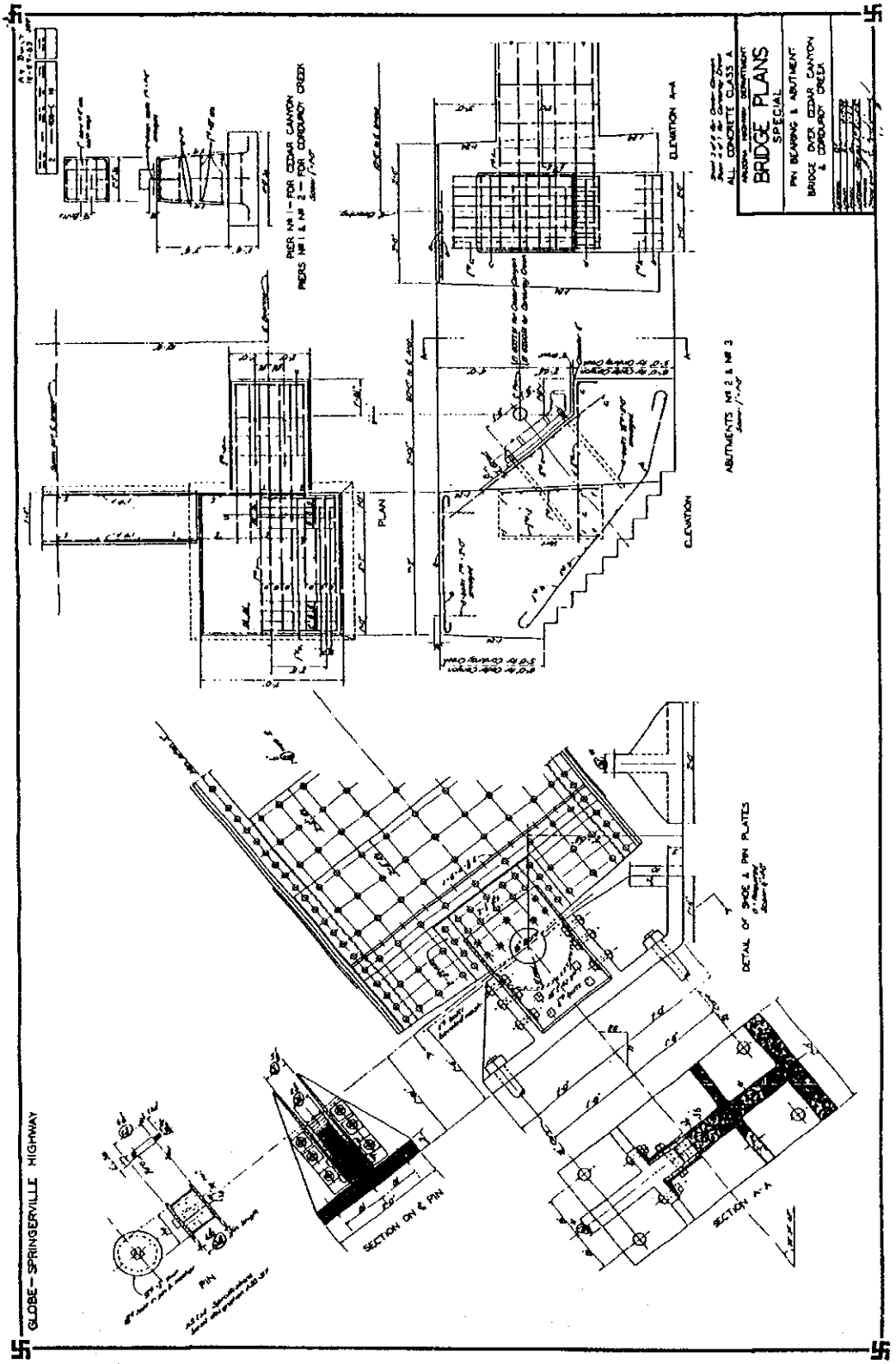
On the following pages are the construction drawings for the Corduroy Creek and Cedar Canyon bridges, produced in 1936 by the Bridge Division of the Arizona Highway Department. The drawings reference a third bridge - over Canyon Padre in Coconino County - a similarly designed steel arch built at the same time as these two bridges.

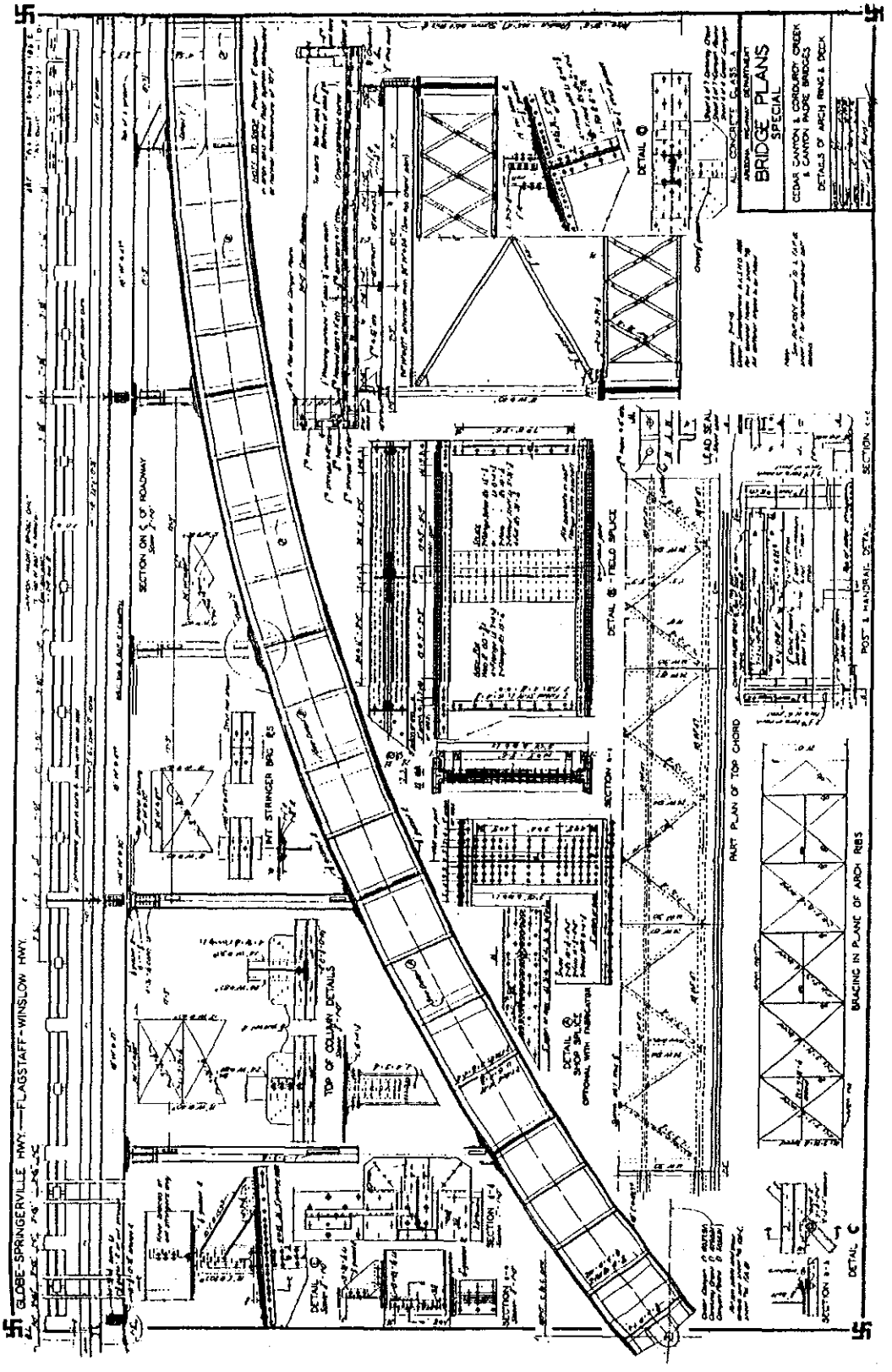

ARIZONA HIGHWAY DEPARTMENT
BRIDGE PLANS
SPECIAL
PLAN & ELEVATION
BRIDGE AT CORDUROY CREEK
PLAN
ELEVATION

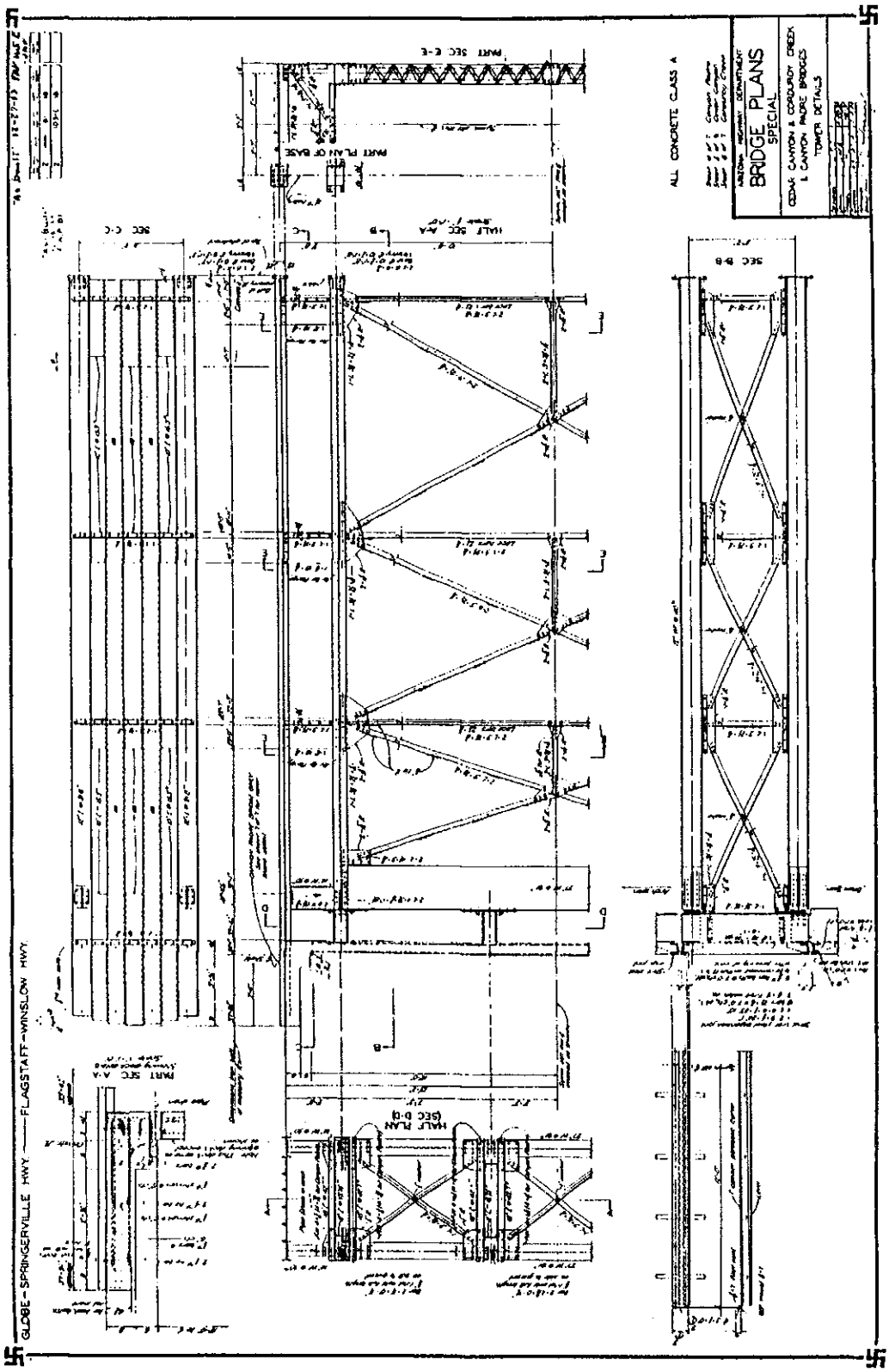

BRIDGE PLANS
SPECIAL
PLAN & ELEVATION
BRIDGE AT CEDAR CANYON
PLAN
ELEVATION
GLOBE - SAN CARLOS HIGHWAY

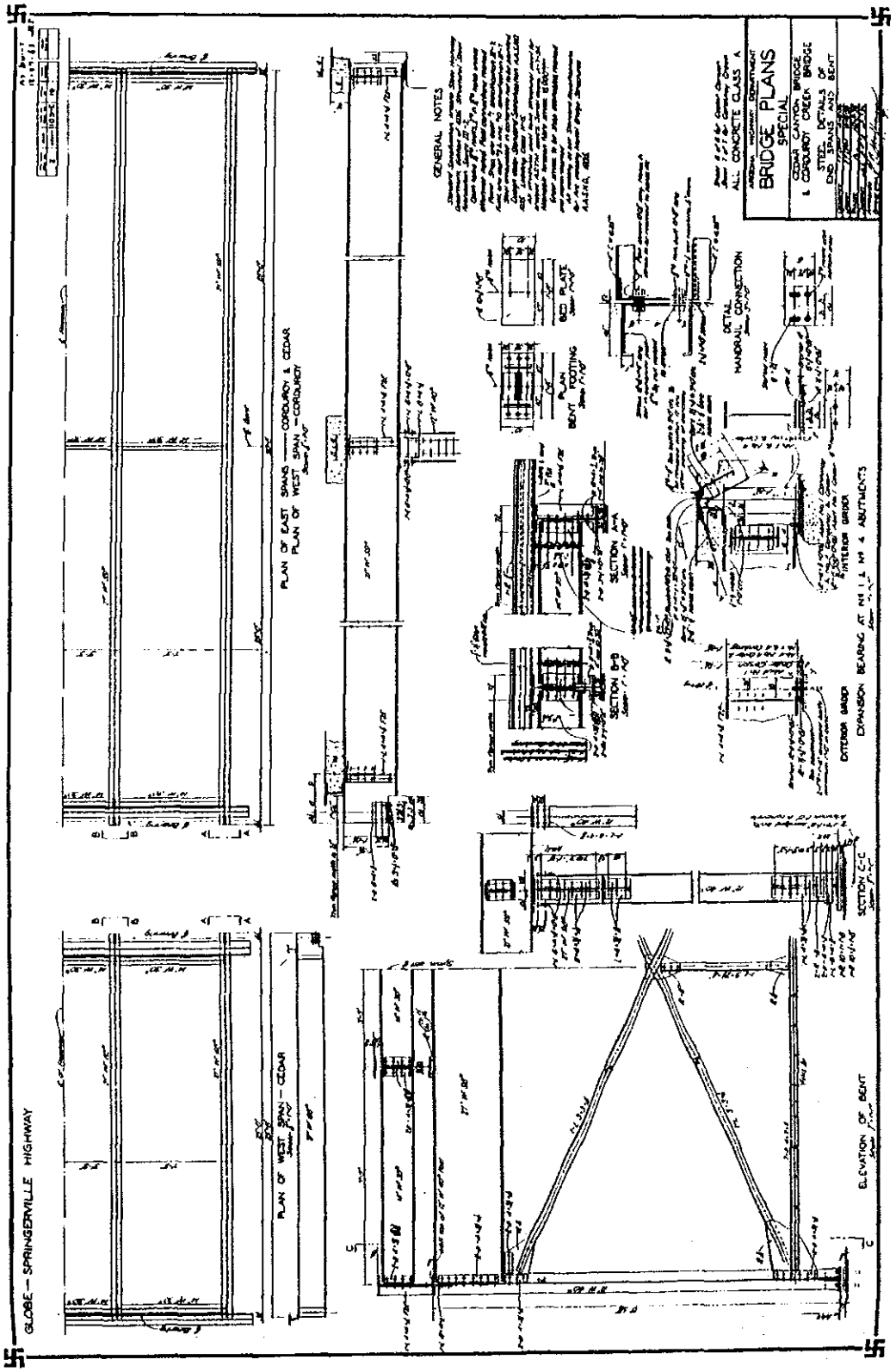

BRIDGE PLANS
SPECIAL
ALL CONCRETE CLASS A
DETAILS OF ABUTMENTS NO.1 & NO.4
CEDAR CANYON STA. 0+00
AND ABUTMENT NO.
CORDUROY CREEK STA. 10+50
SECTION E-E
HALF FRONT ELEVATION
SECTION D-D
PLAN
SIDE ELEVATION
SECTION A-A
HALF FRONT ELEVATION
SECTION B-B
LEAD SEAL
SECTION F-F
HALF SECTION C-C
HALF PLAN
SIDE ELEVATION
GLOBE - SPRINGERVILLE HWY.


BRIDGE PLANS
SPECIAL
CORDUROY CREEK BRIDGE
STA. 1060+
ABUTMENT NO. 4
ALL CONCRETE CLASS A
SIDE ELEVATION
SECTION C-C
SECTION D-D
SECTION A-A
SECTION E-E
SECTION B-B
GLOBE-SPRINGERVILLE HWY.


BRIDGE PLANS
SPECIAL
PIN BEARING & ABUTMENT
BRIDGE OVER CEDAR CANYON
& CORDUROY CREEK
PIER NO 1 - FOR CEDAR CANYON
PIERS NO 1 & NO 2 - FOR CORDUROY CREEK
ELEVATION A-A
PLAN
ELEVATION
ABUTMENTS NO 2 & NO 3
DETAIL OF SHOE & PIN PLATES
SECTION ON & PIN
SECTION A-A
PIN
GLOBE - SPRINGERVILLE HIGHWAY


GLOBE-SPRINGERVILLE HWY.—FLAGSTAFF-WINSLOW HWY.
BRIDGE PLANS
SPECIAL
CEDAR CANYON & CORDUROY CREEK
& CANYON RIDGE BRIDGES
DETAILS OF ARCH RING & DECK
ALL CONCRETE CLASS A
SECTION ON ℄ OF ROADWAY
INT STRINGER BRG
TOP OF COLUMN DETAILS
DETAIL ⊙ FIELD SPLICE
DETAIL ⊙ SHOP SPLICE
OPTIONAL WITH FABRICATOR
PART PLAN OF TOP CHORD
BRACING IN PLANE OF ARCH RIBS
POST & HANDRAIL DETAIL
DETAIL C


BRIDGE PLANS
SPECIAL
CEDAR CANYON & CORDUROY CREEK
& CANYON PADRE BRIDGES
TOWER DETAILS
ALL CONCRETE CLASS A
GLOBE - SPRINGERVILLE HWY. —— FLAGSTAFF - WINSLOW HWY.


BRIDGE PLANS
SPECIAL
GENERAL NOTES
PLAN OF EAST SPANS — CORDUROY & CEDAR
PLAN OF WEST SPAN — CORDUROY
PLAN OF WEST SPAN — CEDAR
ELEVATION OF BENT
GLOBE — SPRINGERVILLE HIGHWAY